UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte LIZHONG SUN, FENG Q. LIU,
SIEW S. NEO, YAN WANG,
STAN D. TSAI, and
LIANG-YUH CHEN

Appeal 2007-3181
Application 10/611,805
Technology Center 1700

Decided: December 14, 2007

Before CHUNG K. PAK, CATHERINE Q. TIMM, and
JEFFREY T. SMITH, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

1Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1, 2, and 5-19. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

I. BACKGROUND

The invention relates to a method of planarizing a surface of a substrate. The process comprises a combination of mechanical polishing and electrochemical polishing to remove conductive material from the substrate. The removal is facilitated by applying a first higher positive electric potential and then a second lower potential between an electrode and polishing medium. The first positive potential is a pulsed potential with a waveform. Claim 1 is illustrative of the subject matter on appeal:

> 1. A method of electrochemically and mechanically planarizing a surface of a substrate, comprising:
>
> (a) providing an electrically conductive solution and an electrode in contact with the electrically conductive solution;
>
> (b) disposing a polishing medium in contact with the electrically conductive solution;
>
> (c) positioning the substrate having a conductive material formed thereon against the polishing medium so that the surface of the substrate contacts the electrically conductive solution and the polishing medium;
>
> (d) applying a first positive potential between the polishing medium and the electrode for a first time period to remove conductive material from the substrate, wherein the first positive potential is a pulsed potential with a waveform; and
>
> (e) applying a second positive potential between the polishing medium and the electrode for a second time period to remove conductive material from the substrate, wherein the second potential is lower than the first potential.

Appellants request review of the following grounds of rejection:

1. The rejection of claims 1, 2, 5-9, 11-13, and 15-18 under 35 U.S.C. § 102(b) as unpatentable over Uzoh (U.S. 5,911,619 issued Jun. 15, 1999);
2. The rejection of claim 14 under 35 U.S.C. § 103(a) as unpatentable over Uzoh in view of Bard et al., Electrochemical Methods, 86 (1980);
3. The rejection of claims 10 and 19 under 35 U.S.C. § 103(a) as unpatentable over Uzoh.

II. DISCUSSION

Appellants' contentions focus on step (d) of claim 1. Specifically, Appellants argue that Uzoh "does not teach, show, or suggest the first positive potential to be a pulsed potential with a waveform." (Br. 9). The Examiner, on the other hand, contends that Uzoh describes such a "pulsed potential with a waveform" in disclosing a process of applying a pulsed DC current, the claim being broad enough to encompass a single pulse of the current as "a pulsed potential with a waveform." (Answer 3 and 7-8). According to Appellants, the Examiner's interpretation does not reasonably include a waveform (Reply Br. 2).

The dispositive issues on appeal arising from the contentions of Appellants and the Examiner are: (1) does the claim language "pulsed potential with a waveform" encompass a single pulse of a waveform; and (2) does Uzoh describe each and every step of the planarizing method of claim 1 including applying a first positive potential which is "a pulsed potential with a waveform?"

We answer both questions in the affirmative.

A preponderance of the evidence of record supports the following Findings of Facts (FF):

1. The definition of a "waveform" is "the shape of a wave, a graph obtained by plotting the instantaneous values of a periodic quantity against the time." waveform. Dictionary.com. *Dictionary.com Unabridged (v 1.1)*. Random House, Inc. (accessed: November 27, 2007).
2. Appellants' use of the word "waveform" is consistent with the common definition. The Specification graphically represents square (Fig. 6), sinusoidal (Fig. 9A) and saw tooth (Fig. 9B) waveforms, and contemplates the use of other waveform shapes (Specification ¶ 0062).
3. The Specification describes the pulse modulation technique as follows:

> Using the electrical pulse modulation technique, a waveform of a voltage signal 610 may be applied for a first time period T1, followed by a zero voltage signal 620 for a second time period T2, as shown in Figure 6. This pattern may have a single cycle or any number of cycles as determined by the controller 312. . . . Although a square waveform is illustrated in the figures, the invention contemplates other types of waveforms, such as sinusoidal (see Figure 9A) and saw tooth (see Figure 9B).

(Specification ¶ 0062.)

4. Uzoh describes a planarizing method combining chemical mechanical planarization and electrochemical planarization (Uzoh, col. 2, ll. 42-

47). In the initial and intermediate stages, when, for example, a large amount of excess material exists in the layer 18, a relatively large electrochemical current flows while the wafer is rotated and pressed against a electrolytic polishing slurry (Uzoh, col. 4, ll. 42-54). Thus, during the initial and intermediate stages, the first portions 18A (Fig. 5) of the layer 18 are removed substantially electrochemically (Uzoh, col. 4, ll. 55-56). As the thickness of layer 18 is decreased, the current is decreased or discontinued, and the chemical-mechanical action of the slurry 74 on the rotating layer 18 becomes dominant to remove the remaining portions 18B of layer 18 (Uzoh, col. 4, ll. 62-67; Fig. 5). Boundaries for the initial, intermediate, and final stages of the method are determined, for example, empirically depending upon the composition of the layer 18 (Uzoh, col. 5, ll. 3-6).

5. The current of Uzoh, generated by a suitable source of potential, is a waveform as shown in Figure 14 (Uzoh, col. 5, ll. 9-16). Figure 14 shows current vs. time waveforms for the electroetching current. This Figure shows, among others, square waveform shapes and saw tooth waveform shapes.
6. Uzoh describes applying a first potential, as a pulsed potential with a waveform, to generate a first higher current as a waveform during initial and intermediate stages of the planarization, and applying a second lower potential to generate a lower current during the last stages of the planarization (Uzoh, col. 4, l. 35 to col. 5, l. 32).

Where there is a dispute over the meaning of claim language, the correct interpretation must be determined before considering the question of anticipation. "[A]s an initial matter, the PTO applies to the verbiage of the

proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification." *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). "[I]t is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention." *United States v. Adams*, 383 U.S. 39, 49 (1966). The specification is always highly relevant. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005).

"To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently." *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997). "The law of anticipation does not require that the reference 'teach' what the subject patent teaches. Assuming that a reference is properly 'prior art,' it is only necessary that the claims under attack, as construed by the court, 'read on' something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or 'fully met' by it." *See Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772 (Fed. Cir. 1983)

Applying the preceding legal principles to the above Factual Findings, we find claim 1 anticipated by Uzoh.

Interpreting the claims as broadly as is reasonable and consistent with the Specification, we determine that "pulsed potential with a waveform" encompasses one pulse with a particular shape such as square, sinusoidal, or saw tooth. Both the plain meaning and the Specification refer to the shape

of a wave as a waveform (FF 1-3). Appellants' claim 1 does not require the presence of multiple pulses at the first potential, it only requires that the first potential be "*a* pulsed potential with a waveform" (emphasis added). Such an interpretation, while broad, is reasonable and consistent with both the Specification and the plain meaning of the terms.

Comparing the process of claim 1 and that of Uzoh, we find that Uzoh describes pulses with the same types of waveform shapes Appellants describe in their Specification. Uzoh describes applying an electroetching current at one magnitude during initial and intermediate stages of material removal and at another lower magnitudes during final stages of removal (FF 4). According to the Uzoh, Figure 14 shows current vs. time waveforms for the electroetching current i (FF 5). As illustrated in Figure 14, the current is in the form of pulses in waveform shape, those pulses are generated by a source of potential (FF 5). One of ordinary skill in the art would have understood Uzoh as teaching the application of a pulsed potential with a waveform for the duration of the initial and intermediate stages of removal. The first applied potential of Uzoh has both the necessary waveform shape and the necessary pulsed potential required by step (d) of claim 1 (FF 4 and 6).

Even if Appellants' claims require applying multiple pulses at the first potential, Uzoh would anticipate what is claimed. While Appellants contend that Uzoh applies the first positive potential for only an instant of time, we cannot agree. Uzoh applies a relatively large electrochemical current during both the initial and intermediate stages of the process (FF 4). The current is supplied for a time sufficient to reduce the thickness of layer 18A. The potential is subsequently decreased during the last stage of the process, the

stage of removing the remaining portions 18B of layer 18 (FF 4). The initial and intermediate stages of planarization necessarily require more than one pulse. This is evident from the fact that the boundaries for the initial, intermediate, and final stages of the process must be determined; they are not merely instantaneous (FF 4).

We find that the process described by Uzoh anticipates the process of claim 1.

With regard to the obviousness rejection of claim 14 over Uzoh in view of Bard, Appellants merely contend that Bard fails to cure the deficiencies of Uzoh (Br. 11). We sustain the rejection for the reasons discussed above.

With regard to the obviousness rejection of claims 10 and 19 over Uzoh, the Examiner has added this rejection to address the additional limitation of repeating steps (d) and (e) of claim 1. Appellants contend that, "[w]hether or not repeating of steps is obvious, [Uzoh] still does not teach, show or suggest" what is claimed (Br. 11-12). Appellants have not presented a sufficiently specific additional argument for our review.[1] We sustain the rejection for the reasons discussed above.

III. DECISION

We sustain the rejection of claims 1, 2, 5-9, 11-13, 15-18 under 35 U.S.C. § 102(b) and the rejections of claims 10, 14, and 19 under 35 U.S.C. § 103(a). The decision of the Examiner is affirmed.

[1] Notwithstanding this position, a person of ordinary skill in the art would have had sufficient skill to repeat steps (d) and (e) until the desired objective of removing the layer 18 is achieved.

IV. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

tf/ls

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